DOI:
10.1080/10400419.2017.1376543

Document Version
Peer reviewed version

Defining creativity with discovery

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First submission May 27th, 2016

Revision submitted 17th December, 2016

Paper accepted September 5th, 2017

Abstract

The standard definition of creativity has enabled significant empirical and theoretical advances, yet contains philosophical conundrums concerning the nature of novelty and the role of recognition and values. In this work we offer an act of conceptual valeting that addresses these issues and in doing so, argue that creativity definitions can be extended through the use of *discovery*. Drawing on dispositional realist philosophy we outline why adding the *discovery and bringing into being of new possibilities* to the definition of creativity can aid theoretical understanding and empirical investigation. Having outlined the case for defining creativity with discovery, three distinct types of *discovery of possibility*, within four domains of creative action, and two types of *bringing into being* are examined for their theoretical and empirical value. We conclude with reflection on future research into the identification and development of creative potential.

Keywords: creativity, discovery, possibility, disposition, critical realism.

Problems with novelty, values and recognition

Creativity is commonly defined through a collection of criteria that tend to consist of: producing something novel, which has value, is adaptive, is relevant to a problem and is recognised (Kaufman and Baer, 2012; Runco and Jaeger, 2012). Whilst originally proposed as a stop-gap (Stein, 1974), the criteria have become an invaluable means through which creativity research is conducted, despite awareness of significant philosophical issues. For example, questions persist over the nature of

novelty (Boden, 2004; Epstein, 1991; Perkins 1994; Smith, 2005) and whether social values and recognition biases interfere with attributions of creativity (Adarves-Yorno, Postmes and Haslam, 2006; Adarves-Yorno, Haslam and Postmes, 2008; Charyton, Basham and Elliot, 2008; Corazza, 2016; Kasof, 1995; Ludwig, 1995; Runco, 1995). Whilst there is acknowledgement creativity exists before its recognition (Corazza, 2016; Runco, 1995; 2003; Sternberg, 1995), in practice researchers require the recognition of these criteria from knowledgeable assessors in order to ensure creativity is being studied. Therefore, the question of what creativity is, outside of recognition, is still contested (Amabile, 1996; Boden, 2004; Corazza, 2016; Csikszentmihalyi, 1999; Martin and Wilson, 2014a; Policastro and Gardner, 1995;).

Problems within three concepts of the standard definition have been identified: the nature of novelty, the role of effectiveness, whether defined through adaptivity or values, and whether recognition is necessary to the existence of creativity. These problems have received significant attention during seven decades of research but remain unresolved (Adarves-Yorno, Haslam and Postmes, 2008; Boden, 2004; Kasof, 1995; Kaufman and Baer, 2012; Runco and Jaeger, 2012; Stein, 1974;). Starting with novelty, there are two philosophical conundrums. First, an explanation of the origin of creative novelty is currently lacking. Important advances have taken place in our understanding how the creative process works and this has undoubtedly advanced theory (Cropley, 2016; Leahy, 2016; Peilloux and Botella, 2016; Reiter-Palmon and Arreola, 2015; Sadler-Smith, 2015). However, the question of why novelty is possible at all, has remained difficult to answer. The philosophical issue of *ex nihilo* creation remains (Boden, 2004; Perkins, 1999) unless a non-contradictory explanation is offered. In mechanical and rather unpoetic terms, we have identified how a creative "engine" works but lack explanation of the combustion within. Understanding why

novelty is possible promises further insight into the creative process because a definition of creativity that does not comment on the origin of novelty is, philosophically speaking, incomplete.

Second, there is a need to understand how to separate creative novelty from other types of novelty. This debate is neatly summarised by Epstein's (1991: 362) observation that, by some criteria, all things, events and people are novel. In other words, each moment of consciousness is unique and each thing produced has features never before in existence. Subsequently, a requirement of creativity theory is to effectively separate creative novelty from all other types. The current solution is to define creative novelty as effective, adaptive or valuable to a particular context and particular people - especially those with trusted expert status (Weisberg, 2015). This approach brings practical and epistemological clarity, as gaining agreement from trusted experts offers a degree of validity and reliability within research (Li et al, 2015; Long, 2014; Piffer and Hur, 2014). However, comment on the nature of creative novelty, independent of these knowledgeable experts, is problematic because of two fundamental philosophical issues.

First, the standard definition offers no comment on whether someone can know whether a new product is creative outside of its recognition. As Csikszentmihalyi questions (1999: 314), if an idea is not afforded recognition, can it be considered creative in the first instance? Such claims render creativity as having no recognition-independent criteria, even in abstraction. A variety of rater biases have been found in the laboratory, in organisational contexts, and across cultures (Kasof, 1995; Hong and Lee, 2015; Hoelscher and Schubert, 2015) and it is known that judgement of creative worth can be influenced by cultural environment, personal biases, through membership of social groups, such as gender, or class, and personal

background or status (Adarves-Yorno, Haslam and Postmes, 2008; Charyton, Basham and Elliott, 2008; Kaufman et al 2010; Lau, Li, and Chu, 2004; Rocavert, 2016; Sayer 2005; Silvia, 2008). Given these issues, relying on knowledgable judges to identify creativity can be problematic as it increases the chances of a success bias in theory, as there could be more ways to achieve creative outputs than are capable of being recognised (Rocavert, 2016; Runco, 2003).

Whilst there have been significant advances in the methods we use (e.g consensual assessment techniques) that can help account for issues of bias, they do not deal with the philosophical issue, rather they offer practical guidance to aid research. Theory therefore lacks criteria to differentiate a creative product, person or process from an uncreative one, outside of the capabilities of the researcher, or the prevailing cultural conditions. The criteria of adaptiveness (Barron, 1968; Runco and Jaeger, 2012), whilst also useful, must be defined in relation to the judgement of others and the values they hold, this means for Weisberg (2015) the same philosophical problem exists. For example, despite a clear lack of gender differences in creativity tests, women are under-represented in creative populations (Baer and Kauffman, 2008). This means they are being denied the economic, social and cultural benefits recognition brings. Developing our definition of creativity, without extending the concept into meaninglessness, must therefore continue to be a vital objective for theory development and will aid those seeking to democratise creative work (Rocavert, 2016).

The second philosophical problem with recognition involves whether creativity is necessarily defined in respect of this criterion (i.e. there is no creativity without recognition), or it is merely a practical requirement that enables creative outcomes (products, processes, artefacts etc.) to be studied. In other words, there is a

debate over whether recognition is an epistemological or ontological necessity. *Epistemological necessity* holds that recognition is required in order to *know* something is creative. For example, psychological theories of creative process and individual differences, as well as some organisational theory, tend to use recognition only as an epistemological or methodological tool (Li et al, 2015; Long, 2014; Piffer and Hur, 2014). The widespread use of consensual assessment techniques and the selection of eminent people into studies, reflect this epistemological necessity (Baer, Kaufman and Gentile, 2004; Moneta et al, 2010; Li et al, 2015; Long, 2014; Piffer and Hur, 2014).

On the other hand, theories that claim recognition as *ontologically necessary*, suggest creativity is a class of things that requires recognition. There is no creativity without recognition. Two types of theory are consistent with this argument. First, system theories suggest creativity is constituted as a relationship between a domain, field and person, whereby creativity exists as a system-level phenomenon (Csikszentmihalyi, 1996). From this position, there can be no creativity without the system, which includes the field (gatekeepers and recognisers) and domains (rules that govern creative endeavours). Systems theory has undoubted theoretical merit and systemic influences on creative production have been identified (Csikszentmihalyi, 2014). Whilst useful, it has a temporal problem. If creativity requires recognition, anything produced prior to recognition cannot be creativity without ontological contradiction. This contradiction extends to claims made about the nature of creative potential and is an unresolved tension within the logic of systems theory (Runco, 1995; 2006; Sternberg, 2006). Technical variations of systems theory have allowed for later recognition of historical significance (Dasgupta, 2011) but these do not resolve the temporal contradiction: prior to recognition, there can be no creativity.

This jars with experience, as we know something is produced before gaining recognition. We also know mistakes in recognition are commonplace (Adarves-Yorno, Postmes, and Haslam, 2006; Licuanan, Dailey and Mumford, 2007). In addition, there is no comment on the origins of novelty within system theories, leaving the *ex nihilo* issue unexplained.

The second type of theory that argues recognition is *ontologically necessary* to the existence of creativity can be broadly, and rather cumbersomely, categorised as social constructionist theory (Richards, 1996; Brown et al, 2010; Mcleod, O'Donohoe and Townley, 2009). The object of enquiry here is the sense-making, power or political processes that govern the label creative. Theories seek to explain and uncover the social, political and economic factors that influence attributions of creativity and in doing so, focus not on what creativity is, but on the sense-making and political processes that surround creative production and recognition (Kasof, 1995). Explaining how creative novel outputs are possible, or offering criteria to identify creativity outside of expert recognition or political negotiation is not the function of such research. It is therefore consistent with this approach to consider creativity as being constituted through acts of recognition.

Taken together, the issues concerning *ex nihilo* creation, the separation of non-creative and creative novel events and the need for reference to adaptiveness and recognition, mean creativity theory is still to offer a complete account of what creative novelty is, why it is possible and how to resolve the competing claims over the ontological status of creativity recognition. Rather than being abstract philosophical debates, they directly affect practice, as without effective criteria, the creative potential of the economically and socially disadvantaged is more likely to go unrecognised, resulting in impoverished theoretical explanations and the risk of

wasted talent (Runco, 2006).

The role of discovery for defining creativity.

Whilst new definitions of creativity have been offered that include alternative criteria, such as aesthetics and authenticity, (Kharkhurin, 2014), or that recognise the importance of potential within creative action and surrounding environments (Corazzo, 2016), recent developments in philosophy, entrepreneurship and education theory hold the promise of using discovery as a new criteria for defining creativity. Discovery generally refers to finding, rather than producing something, yet is commonly associated with creativity. Creativity, it is argued, can lead to discoveries. Researchers have explored different types of scientific discoveries (de Chumaceiro, 1999) and generally argue it is the creative capabilities of scientists, such as Einstein or Darwin, which enabled their break-through discoveries.

However, whilst there is a tension between creativity and discovery (Tweney, 1996) and discovery is often associated with both the creative process and its outputs (Darbellay, et al, 2014; Henderson, 2004; Orlet, 2008) the exact nature of the relationship between creativity and discovery has garnered little discussion. Recently, it has been suggested that creativity can necessarily be defined through discovery (Martin, 2009; Martin and Wilson 2014a; 2014b) and that doing so resolves the philosophical issues within current definitions of creativity. Drawing upon the philosophical insights found within critical and dispositional realism (see Bhaskar 1978; 2000; 2008) they argue using discovery can change the way creativity is defined.

Dispositional realism is a philosophy of science with a radically different conception of causality compared to other realist philosophy. Dispositional

arguments, when applied to creativity theory, result in the conclusion that all creative novelty, arising from human action, must be produced through a process of *discovery and bringing into being of possibility*. Bhaskar asked: What must the world be like in order for science (as the empiricist Hume understood it) to be possible? He argued that because causal relationships can be identified through scientific activity and it takes scientific work to identify these causal relationships, Hume erred in describing causation as only the constant conjunction of events (whenever x then y). Bhaskar noticed that if scientific work is necessary to identify conjunction events, other factors must interfere with such relationships. Whilst a seemingly obvious insight, he suggested Hume, Karl Popper and pragmatists, such as William James, were subsequently incorrect to argue ontology is inconsequential to the philosophy of science and theory building.

This is because if causes are separate from the effects they generate (i.e. even if x exists, y will not always be produced - due to intervening factors) then it follows that causes do not always result in events. This meant Hume's acceptance of causes as only epistemic phenomena (when measured and seen, we can assume causality exists) was flawed. For Bhaskar, causes must be considered causal powers, ontologically distinct from how we come to know causes. In other words, causes act continuously but are separate from the events they generate. From this insight, Bhaskar built a set of ontological arguments to form a dispositional realist philosophy of science that argues we inhabit a natural and social world that is pregnant with possibility.

Bhaskar identified different types of causal powers or dispositions and these were extended through the work of Fleetwood (2009; 2011). Causal powers that are in existence but not producing effects were classified exercised causal powers. For example, a match has the causal power to produce fire but is not always producing

fire. Un-exercised causal powers are those powers that could emerge but are yet to do so. For example, at birth we have the causal power to acquire language but the causal power to speak using language is not yet exercised.

Next we move from exercised to actualised powers, or those actually producing their effects. For example, it is only when the exercised causal powers of an artist to use a brush skilfully is put into practice, that their causal power becomes actualised: they produce a painting. Finally, Bhaskar recognised that even when causal powers are exercised and actualised, these events may not be seen. Archer (2000) argues it is important not to conflate these different causal powers into only those causes that can be measured. In other words, the social world is not exhausted by measurement. Measurement may be necessary to identify and explain causal powers (epistemically) but causal powers continue to exist outside of measurement (ontologically).

Using these arguments Martin (2009) and Martin and Wilson (2014a; 2014b) demonstrate that if the end result of creativity is valuable or adaptive novelty, then Bhaskar's work can be used to explain why it is possible for such novelty to emerge. A world of causal powers must hold the potential for new things to come into being and for things already in being to act in new ways. Specifically, the existence of un-exercised and un-actualised causal powers means new things and new events are possible. New things or events emerge (see Elder-Vass, 2010: 13-39) from each of these types of causal power. In other words, novelty is possible because we live in a world of dispositional propensity that is pregnant with possibility.

There is a history to discussing potential within creativity studies. Un-exercised causal powers could be used to describe creative capacity and exercised causal powers to describe unused creative capabilities (Acar and Runco, 2014;

Corazza, 2016; Runco, 2006; Sternberg, Grigorenko and Singer, 2006). It has also been proposed that creativity must be defined through its potential (Corazza, 2016). However, the consequences of considering the world as one of dispositional propensity have not been used to add any additional criteria to our definition of creativity and this was identified as a crucial omission (Martin, 2009; Martin and Wilson, 2014a; 2014b).

Novelty brought about by human action involves manipulating a dispositional world through a process of production to discover what is possible and to act to bring this possibility into being. A world of dispositional propensity means an additional criterion can be added to the definition of creativity, namely the *discovery and bringing into being of possibility*. Human creativity must always involve discovering what is possible within the propensity of the world and bringing this possibility into being. Such possibilities are 'new' in a variety of senses: (i) new to human knowledge (i.e. epistemologically new); (ii) new in the sense of an un-exercised power becoming exercised (e.g. new type of computer); or (iii) an exercised power becoming actualised (e.g. new property of a thing discovered).

A creative idea can therefore be defined as the representation of possibilities contained within the causal powers of the natural and social world. In making sense of these possibilities, we are discovering them. It is important to add here that this is not to claim that such sense-making is *always* prior to bringing into being. We can make something (a new theory, a new object) and then make sense of its significance, or, we may discover possibilities and subsequently bring them into being. The process of sense-making can be a social process (Wilson, 2010). The discoveries can also be of the material world (as is the case in the natural sciences) and of the social world, including the world of ideas. This process of discovery and bringing into being is

likely to happen iteratively, but it always necessitates awareness at some level.

Whilst the proposition that all creativity involves discovery is derived from abstract philosophical argument, it has practical consequences and is a falsifiable proposition. There should be no example of creativity without a discovery. Whilst this seems obvious for scientific creativity, discovery is not a common word used to describe the artistic creative process, despite artists frequently having their work described as a process of exploration, experimentation, or discovery (e.g. King, 2000; McKee, 2014; Prager, 2012; also Plato on anamnesis; William Blake on the process of engraving – see Quinney, 2010). An artist can discover new ways to communicate about the human condition, as well as the possibilities within the properties of their chosen medium. A musician discovers new combinations of sounds perceivable as melodies and engineers discover ways of using materials. In each of these circumstances there is a discovery, whether that be of the possibilities in natural materials, psychological states, aesthetic appreciation, or audience understanding.

Discovery of possibility also offers philosophical explanation of how novelty emerges. We do not create *ex nihilo*; our creations are bound by the material and social conditions that surround us. From this dispositional realist perspective the *ex nihilo* problem can be resolved in terms of creative possibilities. Any given case of creativity must have the potential to be realised prior to it actually happening. Human creativity is not concerned with the impossible, especially in endeavours such as entrepreneurship (Ramoglou and Tsang, 2016). It is a means of discovering what is possible. Discovery of possibility offers both an explanation of how novelty is possible and extends the definition of creativity.

Crucially, it is not sufficient to theorise creativity solely in terms of the *discovery* of new possibilities. There is a further step that differentiates the process of

creativity from mere discovery, namely bringing into being. It is in categorising the relationship between *discovery of possibility* and *bringing into being* that new opportunities for theoretical development and empirical research into creativity are made possible. This process of production takes place in embodied practices (making, doing, connecting, realising etc.) that give rise to new emergent causal powers, events, or explanations, which come into existence for the first time as the result of the practice being undertaken. Creativity is therefore re-defined as '*the discovery and bringing into being of new possibility*'.

Introducing three types of discovering possibility

Extending the definition of creativity does not allow theory and research to progress unless it enables new research and it is to this challenge we now turn. An enormous variety of 'new possibilities' can be discovered which means theory needs to cut through the complexity such variation brings. Dispositional philosophy offers a route to remove some of the complexity through informing a typography of possibilities, centred on the distinction between unexercised, exercised and actualised causal powers. First, the broadest level of disposition or possibility, an un-exercised causal power, can be used to categorise discoveries of entirely new things. The world contains within it the possibility for change but these possibilities are not endless, they are bound by existing dispositions (Ramoglou and Tsang, 2016). Therefore, the creative act is concerned with what new causal powers *can* emerge (i.e. be exercised). Possibilities of this type are associated with everything from new ideas, theories, inventions, technologies, consumer products, to art, music, literature, and cultural artefacts. As this type of causal power is yet to emerge and is therefore invisible to our senses, imagination or problem finding (Hu et al, 2010) are likely to be key

capabilities for anyone seeking to discover them.

Second, the possibilities held within the exercised but not actualised (i.e. acting) causal powers of things represent an entirely different type of discovery. The discovery of the ability of metal to conduct electricity provides a clear example. Metal could always conduct electricity, so this causal power did not come into being when it was accounted for in scientific theory. Metal had an exercised causal power, which was later actualised (i.e. it conducted electricity). In short, these discoveries involve asking what new events can be produced from existing causal powers. An altogether different example of this category concerns the performance of classical music. It is generally accepted that professional classical musicians are creative when reproducing and interpreting pieces of music. However the question of what is being created has led commentators and musicians alike to question how music can already exist but be interpreted in a creative way (Wilson, 2014). Using the theory proposed here, we suggest that a musical work, made knowable, in part at least, to musicians in the form of a musical score, contains exercised causal powers that are then discovered once more and actualised in a novel performance. The new possibilities associated with old music are explicable in terms of this discovery of exercised causal powers and bringing into being a new actualised event.

Finally, a third category involves the discovery of new explanations for fully exercised and actualised causal powers. The best examples of this category come from the domain of physics. Gravity has been operating around us unchanged, yet it was relatively recent in human history that we were able to explain this force. Gravity was not a hidden possibility, or a latent thing waiting to be brought into being. It is an exercised and actualised causal power and it has always been producing empirical events. Yet human creativity was necessary to discover what it was, and how it works.

These types of discovery involve identifying explanations for causal powers that exist and act but we cannot explain why.

Domains of discovery: Material, agential, structural & analytical creativity

Distinguishing three types of possibility can aid explanation of variation in creative processes. However, *discovery and bringing into being of possibility* applies to many contexts, so it is necessary to ask what new ideas, theories, and explanations are *about*, and what *sort* of practice, products and realisations are involved. *Domains* of discovery will therefore influence how bringing into being operates in practice. Archer (2000) identified several domains, relevant to creativity theory, which differ according to whether they concern the material, agential, structural or analytical world. Analytically separating the natural and social world, through the lens of dispositional realism, into four domains of possibility enables variation in creative practices to be identified. *Material creativity* refers to discoveries of the natural world, *agential creativity* refers to discoveries of the self, *structural creativity* is concerned with discoveries within social structures, and *analytical creativity* is concerned with discoveries within abstract systems of thought.

Whilst it is possible to separate these domains in abstraction, in practice creativity happens within and across multiple domains. Great literature can simultaneously make discoveries (for author and readers alike) about the possibilities for explaining the human condition (self/structural), the process of expression (self/structural/analytical) and an audience's propensity to learn, grow, be influenced, or moved by a story (self/structural). Using domains of discovery in this way dovetails with research that suggests there are context dependent hierarchies of creativity, and with research that explores whether creativity is domain general or

domain specific (Baer and Kaufman, 2005; Blazhenkova and Kozhevnikov, 2016; Feist, 2004; Julmi and Scherm, 2015; Simonton 2009). The addition of discovery of possibility and bringing into being to the definition of creativity, provides a new conceptual framework for researching how such hierarchies might interact within domains.

Two types of bringing into being

The final insight dispositional realism offers is to distinguish two types of creative production, or processes of bringing into being. Creativity involves both intellectual and practical labour. Some creative work can be highly abstract and intellectual in nature (mathematics); other work is characteristically embodied (theatre, dance); involves making and doing (production, design); or is more or less performative (the creative arts). Bhaskar described *transitive* objects as fallibly changing perspectives of the world (i.e. our ideas, theories and explanations about objects in the world). These are real, in the sense that they are objects of the social world but they are open to change as they are constituted through our cognition. On the other hand, *intransitive* objects, have an existence that can continue, regardless of the ideas we may hold about them. It is therefore possible to offer two further classifications of creativity around the nature of the work being done to bring into being new possibilities.

Creativity$_1$ (ideas, theories, explanations etc.) involves the discovery of new possibilities, through bringing into being a conscious notion or idea that represents these possibilities. In other words, when we discover a new possibility in the transitive domain, we bring the idea of that discovery into consciousness. Creativity$_2$ focuses on the embodied practices, products, realisations of the material world, and

involves bringing into being, or the realisation of an artefact, practice, or product that can exist independent of our cognition. In dispositional realist terms, the bringing into being involves a process of transforming un-exercised causal powers into exercised ones, or exercised causal powers into actualised powers. In practice, creativity often involves both the bringing into being of transitive ideas, as well as intransitive products. For example, when we refer to the invention of the smart-phone as an exemplar of creativity, we acknowledge the discovery of possibilities within our cognition, for example, the very idea of such a device with its multi-functions, touch screen, and so on, as well as the bringing into being of a new product (i.e. the smart-phone itself).

Distinguishing creativity in this way is important because creative ideas can remain latent, especially when developing products that require financial, time or resource investment. An unpublished manuscript, an unexploited patent, or a script not produced are some of the many examples of creative work where ideas have been generated, possibilities uncovered but the realisation of value is unfulfilled. Taken together these insights into type and domain of discovery, combined with the two types of bringing into being, offer new opportunities to investigate whether discovery and bringing into being can aid causal explanation of creativity, the creative process and, especially, extending what can be considered as creative potential outside of recognition. In table 1 we offer a preliminary sketch of the types of research made possible through comparing two types of creativity (new literature and new computing technologies) and how the action involved can be different depending on the type of possibility, the domain of action and whether it involves the bringing into being of an idea, product, or both.

<insert table 1 about here>

Discussion

In this article, we offer an account of creativity that attempts to reconcile philosophical problems with novelty, value and recognition. Creativity is theorised to necessarily involve *discovery of new possibility and bringing it into being.* In order for adaptive or creative novelty to be produced and recognised, discovery of possibility and bringing into being must have occurred. Through doing this, new criteria with which to assess, explain and judge creativity have been proposed. Three distinct types of discovery of possibilities are identified and four domains of activity proposed. This enabled two types of bringing into being to be classified: creativity$_1$ – the bringing into being of creative ideas, theories and explanations; and creativity$_2$ – the bringing into being of new embodied practices, products or realisations.

Creativity is possible because we live in a world of dispositional propensity. We do not produce *ex nihilo*, we discover possibilities and bring the novelty they hold into being. This builds on work attempting to separate creative work from its recognition through offering additional criteria to aid understanding of the creative process. In the case of new ideas, theories and explanations (creativity$_1$), these are brought into being *through* being discovered (i.e. revealed, uncovered, found). Creative products in the material world (creativity$_2$), by contrast, require being discovered *and* bringing into being.

A consequence of this analysis is to recognise that for creative work to bring about change, or have its value recognised, a double discovery must be made. First, the possibility for the creative product itself needs discovering and bringing into being. Second, its value needs recognising, or indeed discovering by an audience. The

influence of creativity is contingent upon collaboration but this collaboration does not define creativity ontologically. However, the necessity of a double discovery, for change to occur, could mean that receivers of ideas need to have similar levels of creative capabilities in order to effectively discover value. Whereas creative collaboration, with recognisers in a domain, is currently considered *prime facie* evidence of the necessity of recognition for creativity to exist (McKerracher, 2016; Reisman, Keiser and Otti, 2016; Sarsani, 2008), the crucial advantage of this approach is that it follows that creative potential could be as needed as much within those tasked with the recognition and reception of ideas, as those who produce it. This opens a promising avenue of research into the role of active audiences, beyond that recognised within the literature on co-creation teams. For example, Dufrenne, 1973 argued that far from being a passive recipient of the music in a live performance, the audience can co-create the music through an act of discovery, in this case involving the discovery and bringing into being of an aesthetic object.

Discoveries can be specified, domains identified, types of bringing into being understood and each of these criteria provides additional means through which the creative process can be understood. Creativity educators can therefore use this approach to understand whether all the capabilities required to be creative (i.e. make such discoveries, bring such things into being) are held within an individual or group. For example, one may have the means to make discoveries in a particular domain but lack the ability to discover how to win audience acceptance. Research has yet to conclude whether higher order or abstract categories of creativity can transcend domains. If such categories exist (Welling, 2007), this dispositional realist approach also offers a new method to identify which creative capabilities are domain general and which are domain specific, leading to the realisation of creativity training based

on types of discovery and bringing into being attempted.

Much is already known about discovery processes (Simon, 1980) but this is rarely applied to understanding creativity. For example, a vital implication of our approach to defining creativity is that discovery of possibility must presuppose awareness. The existence of possibilities is qualitatively different to awareness of them. Exploring the interaction between awareness and creative work seems to us a promising line of enquiry. Research that explores the present-moment awareness of creative action, could extend further into everyday creative practice (Brown, 2008; Raina, 2013; see also Richards, 2007). For example, known discoveries, within an organised system (material, self, analytical etc.), could be used to analyse the conditions that foster awareness of discoveries, and those that hinder it. The implication being, greater understanding of discovery processes will directly enhance creative abilities, and training in awareness, or in the conscious representation of realistic problems (Cunningham and MacGregor, 2008) will enhance sensitivity to discoveries being made.

A concluding thought is to suggest that the work done here might be of particular interest to those seeking to implement a more sustainable approach to human creativity. The rhetoric of creativity carries with it a lingering modernist focus on the shock of the new. Discovery, with its implicit alignment towards identifying and making more of what is already here, points towards a different conceptualisation where the promise, at least, of taking the sustainability agenda seriously, not as a nice to have adjunct, becomes a foundation of what we understand creativity to be.

(5, 499 words, excluding references)

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Table 1: Research program utilizing a typology of creative production focused on type and domain of discovery.

Types of Creative output	Types of discovery of possibility	Domain of discovery	Research program
New piece of literature	**Unexercised potentials** - Imagining an entirely new fictional world. **Exercised potentials** - Imagining new combinations of plot and characters within an already created world and analysing their effects on story. **Actualized potentials** - Generating an entirely new explanation for why people act the way they do and encapsulating this within a character. Discovering something about human nature and describing it for the first time. The artist as observer.	**Material** - Within science fiction it might involve imagining new machinery or technology. **Self** - new insights into the human psyche, making public inner thoughts, and communicating our shared humanity. **Social** - discovering new tropes that explain how society is organized, discovering new power structures that better explain variation in behavior. **Analytical** - Taking an existing genre of fiction, plot types, story modes and re-combining them to find incremental story innovations.	Which capabilities need developing to enhance the quality of learning? The quality of output? For which types of discovery? Within which domains of discovery? What type of bringing into being is involved? Can the types of bringing into being be combined in practice? To what effect?
New computer technology	**Unexercised potentials** - Imagining and discovering an entirely new technology, something which has an inventive step, has intellectual property attached and is new to history. **Exercised potentials** - Taking an existing computer programming language and configuring it to do new things, such as programming a new type of application for a smart phone. **Actualized potentials** - Developing new understanding or explanations within computing theory.	**Material** - discoveries of possibilities for computing within physics, chemistry, or biology. **Self** - Discoveries of the human condition (e.g. reasoning bias) which influence human computer interaction and the design of programs and applications. **Social** - Discovering new possibilities for communication that aid ICT development. **Analytical** - discovery of possibilities within existing conceptual frameworks or problem spaces (what is possible but unexplored within a system of logic) and invention of new systems of logic.	Which capabilities need developing to enhance the quality of learning? The quality of output? For which types of discovery? Within which domains of discovery? Which type of bringing into being is involved? Can the types of bringing into being be combined in practice? To what effect?